Supplementary Information for

A family of all sp^2-bonded carbon allotropes of topological semimetals with strain-robust nodal-lines

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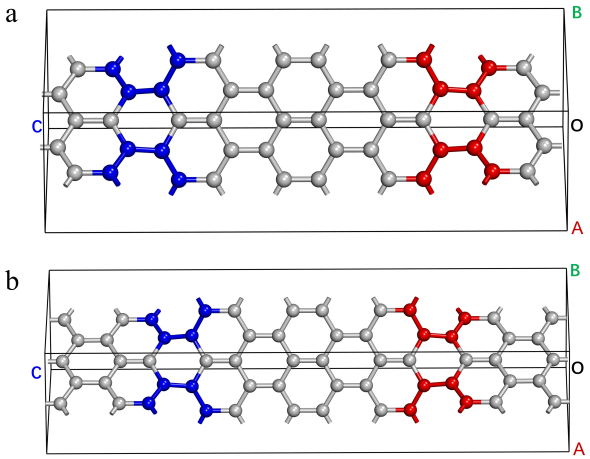

Fig. S1. Structures for *mrs*-C_{40} and *ors*-C_{48}. (a) Perspective of *mrs*-C_{40}, containing 40 atoms in the unit cell with lattice parameters a= 4.931 Å, b=4.925 Å and c=21.118 Å. (b) The 48-atoms unit cell of *ors*-C_{48} with lattice parameters a= 4.925 Å, b=4.925 Å and c=25.118 Å.

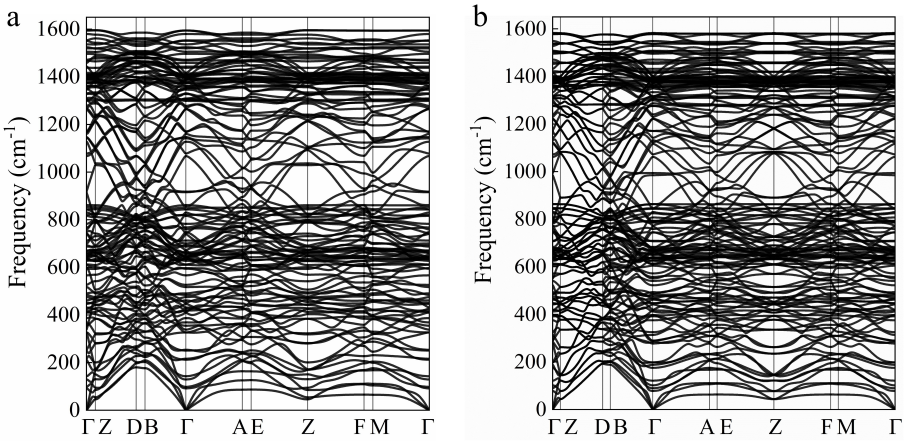

Fig. S2. Calculated phonon dispersion of *mrs*-C_{40} (a) and *ors*-C_{48} (b) at zero pressure.

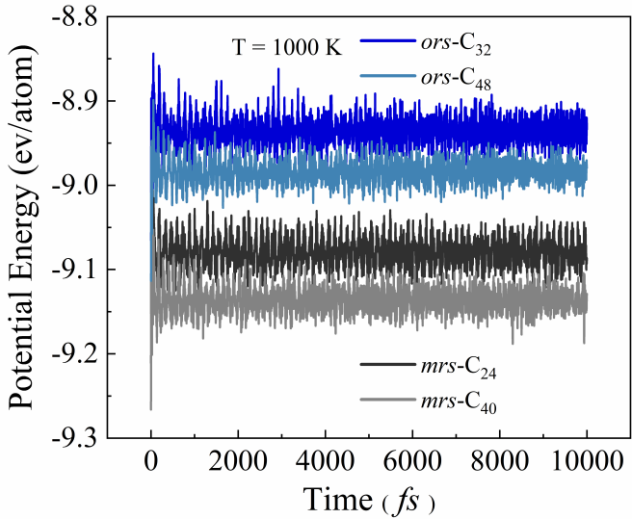

Fig. S3. Potential energy fluctuation of *mrs*-C_{24}, *ors*-C_{32}, *mrs*-C_{40} and *ors*-C_{48} in AIMD simulations at 1000 K.

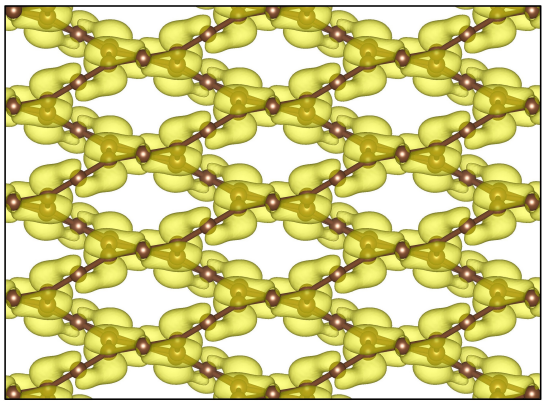

Fig. S4. Partial charge density of the highest valence band (HVB) and the lowest conduction band (LCB) near the Dirac states in the *mrs*-C_{24}, the isosurface level is 0.04 e/Å^3.

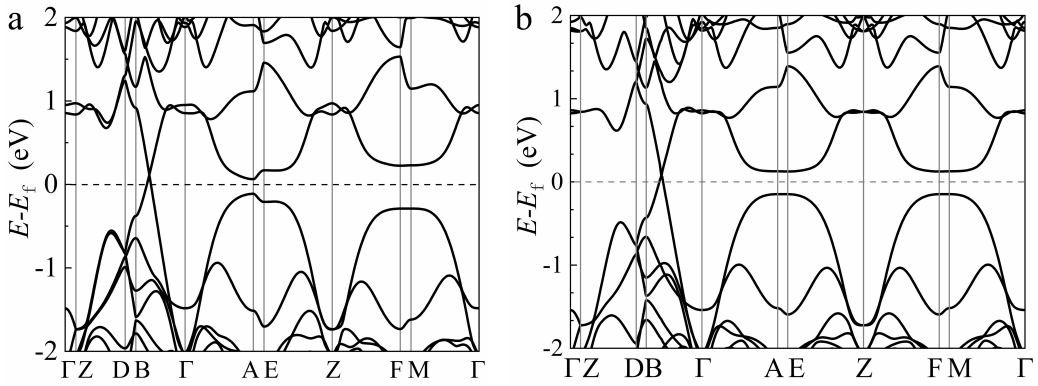

Fig. S5. Bulk band structures of *mrs*-C_{40} (a) and *ors*-C_{48} (b) along the high-symmetry pathways, which linearly cross near the Fermi level along the B-Γ path.

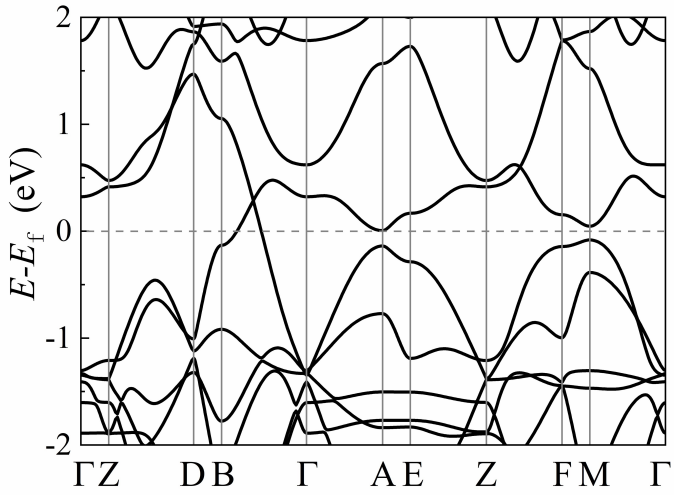

Fig. S6. Bulk band structure of the *mrs*-C_{40} along the high-symmetry pathways at a tensile strain of ε_z=60%.

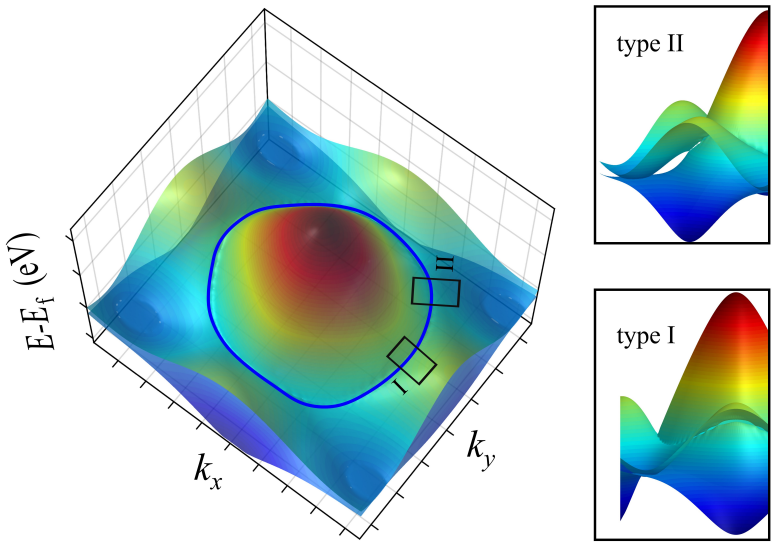

Fig. S7. 3D energy-momentum plots of the *ors*-C_{32} in low-energy states at a tensile strain of ε_z = 65%. Band crossings belonging to types I and II are marked by I and II, respectively.

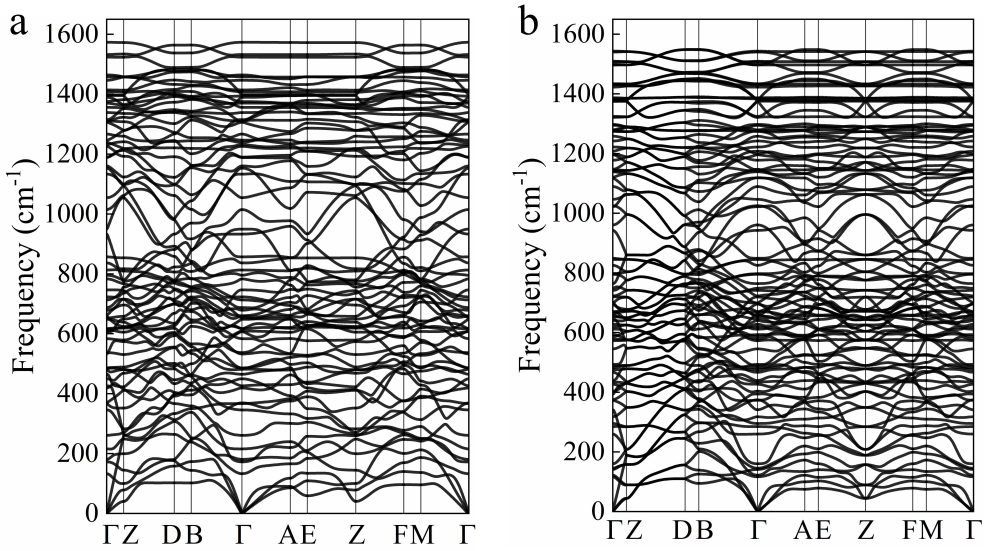

Fig. S8. Phonon band dispersions of *mrs*-C_{24} and *ors*-C_{32} under tensile strain. (a) The phonon dispersion of the *mrs*-C_{24} at a tensile strain of ε_z=50%. (b) The phonon dispersion of the *ors*-C_{32} at a tensile strain of ε_z=75%.

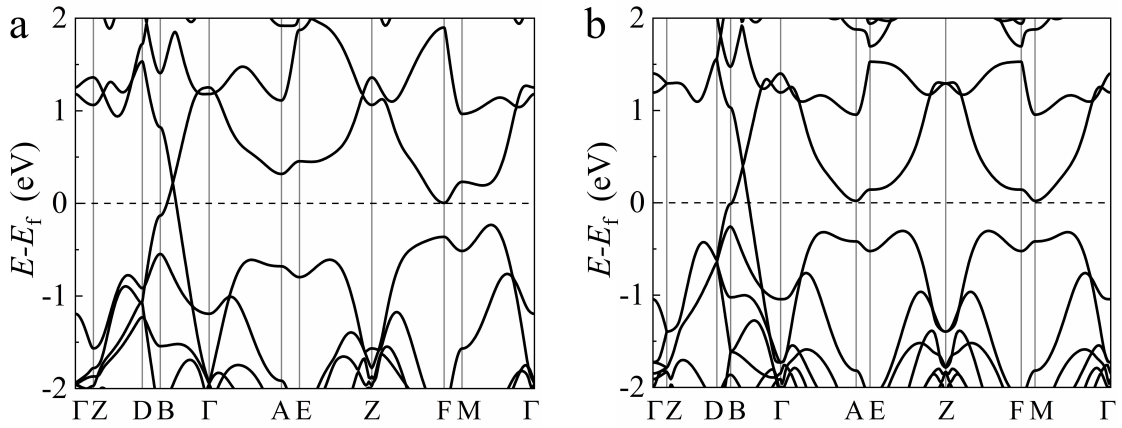

Fig. S9. Bulk band structures of *mrs*-C_{24} and *ors*-C_{32} under compressive strain. (a) The bulk band structure of the *mrs*-C_{24} at a compressive strain of ε_z=3%. (b) The bulk band structure of the *ors*-C_{32} at a compressive strain of ε_z=7%.